

THESES OF DOCTORAL (PhD) DISSERTATION

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**THESIS OF DOCTORAL (PhD) DISSERTATION
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**APPLICATION OF DIFFERENT SELECTION AND
BIOTECHNICAL METHODS FOR RENTABLE GOAT BREEDING**

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1. INTRODUCTION

Nowadays in our home breeding goat is a prospering section again within breeding ruminants. Despite this organizing of selling good-quality milk, dairy products and seasonal milky goat kids for goat breeding farms means an important problem. Using the possibilities given by up-to-date breeding and biotechnical methods plays an important role in improving both income sources also qualitatively and quantitatively.

From the point of yielding milk one has to aspire with the help of selection to a substance that consists of individuals with good condition, are healthy, have a high milk yield and long lifetime. Unlike selling raw milk selling cheese can realize a much higher income, thus milk constituent markers are important.

From the point of selling or exporting goat kid is important that mothers are paired with billy goats with high breeding rate. Since in the newly joined members of the European Union goat kids are cheaper, in our home biotechnical methods, that help us raising goat kids which reach the right export weight (for Eastern, Whitsun or Christmas) needed by the market and which can be sold for the highest price, are emphasized.

For the farms that choose double utilization (both milk and meat) is very important to produce enough milk throughout the whole year and to raise goat kids with the right weight for the time of buying up. This means that artificial insemination, applying induced and synchronized fertility has to be emphasized in the future, thus farmers breeding goat were able for an effective and profitable production.

2. OWN SURVEYS

2.1. Aims of the experiments

My goal is to develop a new evaluating index for breeding ratio and new economical indexes with biotechnical methods (like artificial insemination with fresh, cooled and cryogenic semen, cervicouterinal artificial insemination, inducing of fertility, synchronizing of fertility) those in home goat breeding among industrial circumstances yet unused are, thus the individual breeding animals objectively comparable were.

2.2. Material and methods

Monitoring of milk production

The monitoring of milk production was made in four main breeds from the results gained from regular milkings. The milkings were repeated monthly and their yearly means were examined at the individuals of Saanen and alpine species. Milk production was examined with the help of milked days (day), fully lactation amount (kg), and daily milk amount (kg/day).

Monitoring of constituents of milk

Milk constituents' examination was done weekly through 9 weeks. Milkings were done in the morning. Saanen, alpine and noble hungarian goats were examined. Analyzing of samples' were done in the Milk Farming Experimental Institute Mosonmagyaróvár. Examining points of view were: butterfat, casein, lactose, dry constituent, fatless dry constituent and number of somatic cells.

Udder morphology

The aim of udder judge is to establish if the individual's udder is suitable for machinery milking, and in what degree is it expectable after more lactations that the individual will keep these features. Part of the features were judged on a linear scale, other ones were taken as quantitative features. Manual examination: udder morphological features are noticed in the second trimester of the lactation before the morning milking. The examined species were: Saanen, alpine and hungarian fallow. When examining udder features were judged on a scale from 1 to 9 (former udder joint, back udder joint, hanging, deepness). At udder nipples sizes were taken with mm precisely (state of udder nipple, length and thickness) (Table 12).

Examination of meat growth

During our examinations 20 Boer, 20 F1 (hungarian fallow x Boer) and 20 hungarian fallow goat kid's weight data were taken from birth til 80 days age. Measurements were done in every 2 days in the first 2 weeks always at the same period of day, later weekly measurements were done. Measurements were done by a scale with dkg preciseness. Also daily weight gain was calculated.

Reproduction

Our examinations regarding to productivity and breeding ratio were done in 4 hungarian main breeding. The examined species were Saanen and alpine mother goats kept among half-intensive circumstances. During our examinations 3 years' results were evaluated. Points of interests were rate of yeans (pcs/yeans), type of yeans and correlation between type of yeans and milk amount.

Examination of temperament

The examined substance contained 181 mothers whose distribution after species was the following: Saanen (n=54), alpine (n=65), noble hungarian (n=62). The goats' temperament-test was made by scale-test. During the test the animals stayed for 30 seconds on the scale, while their behavior was judged on a scale from 1 to 5.

Examination of artificial insemination

Our examinations were done on 2009 in a farm with mixed substance (alpine, Saanen, noble hungarian). Fertility synchronizing of mother goats were based on a spanish-english technology. The gained semen was thinned with synthetic thinner. After thinning the semen was cooled through 2,5-3 hours while 2-4 °C were reached. The mothers matured that day were fertilized with the cooled semen.

Economical examinations

During the economical examinations with using the gained statistical results we would like to create the economical indexes that were unused in goat breeding until now. With the help of the indexes the breeding animal are objectively and economically comparable.

2.3. Experimental methods

3.1.3. Experimental methods

For easier survey of the tasks completed during our examinations the following summarizing table gives some help (*Table 1*).

Table 1: Summary of examination locations, examined features and applied statistical methods

Examined farm	Examined species	Examined substance	Examined number of individuals	Applied statistical methods
1.1. Examinations of milk amount (number of days milked (day), lactation milk yield (kg), milk amount per day (kg/day))				
A	- alpine - Saanen	mother	n=102 n=28	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X ² -value
B	- alpine	mother	n=246	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X ² -value
C	- alpine - Saanen	mother	n=30 n=50	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X ² -value
D	- Saanen	mother	n=131	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X ² -value

1.2. Examinations of constituents of milk (fat%, protein%, lactose, dry constituent, fatless dry constituent)				
E	- alpine - Saanen -hungarian fallow	mother	n=15 n=15 n=15	Kolmogorov-Smirnov-test, Levene-test, GLM, LSD, Pearson's rank-correlation
1.3. Examinations of udder morphology				
E	- alpine - Saanen - hungarian fallow	mother	-32 -30 -30	Kolmogorov-Smirnov-test, Levene-test, Kruskal-Wallis-test, one-way Anova
F	- alpine - Saanen - hungarian fallow	mother	n=17 n=39 n=40	Kolmogorov-Smirnov-test, Levene-test, Kruskal-Wallis-test, one-way Anova
1.4. Examinations of somatic cells (Sc, log10)				
E	- alpine - Saanen - hungarian fallow	mother	n=15 n=15 n=15	Spearman's rank-correlation
2. Examination of meat growth (birth weight, election weight, daily weight gain)				
G	- Boer - F1 (hungarian fallow x Boer) - hungarian	kid	n=20 n=20 n=20	Kruskal-Wallis-test Levene-test

	fallow			
3. Productivity, breeding ratio (correlation between rate of year substance (pcs/year), type of year and produced amount of milk)				
A	- alpine - Saanen	mother	n=102 n=28	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X^2 -value, Turkey-proof
B	- alpine	mother	n=246	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X^2 -value, Turkey-proof
C	- alpine - Saanen	mother	n=30 n=50	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis test, X^2 -value, Turkey-proof
D	- Saanen	mother	n=131	Kolmogorov-Smirnov-test, Levene-test, ANOVA, Kruskal-Wallis-test, X^2 -value, Turkey-proof
4. Examinations of temperament (Scale-test; 1-5 point)				
E	- Saanen - alpine - hungarian fallow	mother	n=54 n=65 n=62	Kolmogorov-Smirnov-test, Man-Whitney-test, Kruskal-Wallis-test, Spearman's correlation analysis

5. Examinations regarding to artificial insemination (ability for being pregnant % , yeap%)				
E	- mixed substance	mother	n=150 n=119	-

2.4. Statistical analysis

The statistical evaluation of the results of experimentations were done by program package SPSS 14.0.

3. Results and evaluations

Examination of milk amount

A statistically provable significant difference was to be identified between the lactation and daily milk production of the alpine kind of the main cultures named A, B and C; respectively between the length of lactation, lactation milk yield and daily milk yield of the Saanen kind of the main cultures named A, C and D.

Examination of constituents of milk

In case of goat species we can establish that based on the variance analysis done the effect of species influences the casein% and dry constituent% marker of goat milk in a rate of $P < 0.05$. Other factors that influence the consistence of milk (protein%, lactose%, fatless dry constituent% and somatic cell number) are not related with the effect of species.

Examination of udder morphology

Based on the results of the finished examination it is to state that the hungarian fallow kind did not differ from the other two regarding to udder depth, length of udder nipple and -thickness. But examining the other features of the udder (ETRI, HTRI, hanging of udder) the hungarian fallow kind showed essential weaker results. We also stated that in pursuance of udder morphology examinations the Saanen kind reached the best rate, thus from the point of qualitative milk yield and milkability we suggest the breeding of Saanen kind goats.

Examination of correlations between somatic cell number and attributes of udder morphology

Between the hanging of udder and somatic cell number content of milk a negative mean correlation was given; in case of udder depth and somatic cell number a positive mean strength correlation was given. In case of udder depth we experienced a positive mean strength correlation. Between position of udder nipple and number of somatic cells a weak positive correlation was to be experienced. The more the angle between the udder nipple and the ground approximates the rectangular, the better it suits the milking chalice, thus the milkability is better and the number of somatic cells decreases. Between the length of udder nipple and somatic cell number is a weak negative correlation to be stated. After the gained results we can show that individuals with longer udder nipple are more exposed to outer infections (e.g. litter), and also the number of somatic cells can increase due to disadvantageous udder nipple position. Between udder nipple thickness

and number of somatic cells there a strong negative correlation was to be experienced. By the individuals possessing thicker udder nipple high somatic cell number can occur at a bigger rate.

Examination of meat growth

From our examinations it turned out, that Boer cross-bred kids also reach the minimal weight limit (8 kg) much sooner than the fallowian kids. The F1 kids' birth weight is already bigger and this advantage increases thanks to daily weight gain. We observed that kids in all the three groups developed more intensively until they 40 days age, than in the following 40 days. Based on the examination of the daily weight gain of the three genotypes we can state that Boer kids achieved the best result (215 g/day), they were followed by the F1 (176g/day) and the fallowian kids (159 g/day). As age progresses, fattening costs more and more. The weight surplus thanks to the cross-breeding means financial benefit for all farmers. The meat quality of hungarian fallow substances can significantly improved with using Boer bucks. Already after the first cross-breeding sturdy improvement of meat producing ability shows. With further increasing of Boer blood rate this result is continuously improvable.

Reproduction

We experienced a significant difference among the different farms in the distribution of yearn type and growth rate. In case of alpine kind we experienced a significant difference between the lactation milk yield, the daily milk yield and type of yearn. In case of Saanen kind the yearn type significantly influenced the length of lactation, the lactation milk yield and

the daily milk yield. Based on our examinations it is to state that at both kinds of goat the mothers yeaned one kid yielded the less milk, while as number of kids grew, the lactation milk yield also grew pro rata. From the two examined goat types among the farms we studied the alpine kind showed the biggest milk yield between different yeand types, thus in the long run in the farms with double utilization (both milk and meat) in case of half-intensive keeping towards effective production we suggest breeding this kind of goat.

Temperament

Our results show that the scale test is suitable for determining goats' temperament similar to cattle and sheep species. We established a statistically provable difference among the temperament-scores of the examined species. By the results from the three examined species (alpine, Saanen, noble hungarian) the Saanen mother goats were the calmest. Confirming the results of earlier examinations regarding to cattle we proved, that with progressing age temper changes; the younger mother goats are more temperament than the elder ones.

Examinations of biotechnical processes

It turned out during the inseminations that the mother goats showed individual variances towards the hormone treatments. In the synchronizing technology and defining exact time of insemination we occasionally got weaker results than expected. It is important to define the exact time of insemination while applying this technology. The "filtering" of the bucks based on their individual sensitiveness is important. The task of further

examinations and experiments will be to find a solution for these problems for the sake of improving the fertility rate. With the help of different painting procedures and with examining the different phases we try to find and eliminate the critical points. During the artificial insemination of mother goats with fresh or 2-4°C cooled buck semen in the breeding season essentially (with 20-25% more) better pregnancy results can be achieved than beyond the breeding season.

Economical examination of keeping and breeding goat

With the utilization of our examination results and literary data we worked out the milk-producing and meat-producing goat economical index. In the future by comparing mother goats it is expedient to use this index. This index is also suitable to evaluate and compare examinations of breeding bucks' progeniture's efficiency. The factors in the formula can change by the all-time factors that influence thrift.

4. NEW SCIENTIFIC RESULTS

New scientific results

1. During examination of the hungarian fallow goat species – kept among identical keeping and foraging circumstances – jointly evaluated udder and udder morphology features influence the yielded amount of milk and number of somatic cells in a different degree (39 %, $P < 0,0001$ and 91 %, $P < 0,0001$).
2. Based on the results of temperament examinations among the examined three types (Saanen, alpine, noble hungarian) the Saanen ones were the most calm. In case of goat species we proved that with the progress of age temper changes; younger mother goats are more temperament than elder ones.
3. Examining the daily weight gain of the three genotypes we can state that the Boer kids (215 g/day) achieved the best result, they were followed by the F1 (176 g/day) and fallow ones (159 g/day). The meat quality of the hungarian fallow substances can significantly improved with Boer bucks. Already after the first cross-breeding sturdy improvement of meat producing ability shows. With further increasing of Boer blood rate this result is continuously improvable.
4. During the artificial insemination the deliberated time of semination influences considerably the effectiveness of the applied technology. In case of synchronization of maturing

beyond breeding season significant individual differences show up in mother goats becoming pregnant. During the artificial insemination of mother goats with fresh or 2-4°C cooled buck semen in the breeding season essentially (with 20-25% more) better pregnancy results can be achieved than beyond the breeding season.

5. In our home regarding to goat species I worked out the milk- and meat producing economical indexes usable for objective economical evaluation of breeding facilitating value-measuring features as a pioneer.

5. PUBLICATION CATALOGUE

1. Fully published discourses kept on scientific conferences

1. **Németh, Sz** – Gulyás, L. (2008) Economical examination of goat milk production. *50th Jubilee Georgikon Days*, Keszthely, 26th September 2008.
2. Gulyás, L – **Németh, Sz.** (2008) Economical examination of goat breeding. *33rd Scientific day of Óvár*, Mosonmagyaróvár, 9th October 2008.
3. **Németh, Sz.** – Gulyás, L. – Orbán, M (2009) Temper examinations of goat species. *15th Youth Scientific Forum*, Keszthely, 16th April, 2009.
4. **Németh, Sz.** – Gulyás, L. – Orbán, M. (2009) Situation and possibilities of goat breeding in the European Union and in Hungary. *Vision of agriculture and the country, Scientific Conference*, Mosonmagyaróvár, 17-18th April, 2009.
5. **Németh, Sz.** – Pajor, F. – Orbán, M. – Tóth, T. – Póti, P. – Gulyás, L. (2009) Udder morphology examinations of different goat species. *51st Georgikon Days*, Keszthely, 1-2nd October, 2009.
6. **Németh, Sz.** – Pajor, F. – Orbán, M. – Tóth, T. – Gulyás, L. (2009) Evaluation of udder morphology features of different genotype mother goats. *19th Congress of the Hungarian Buiatric Company*, Debrecen, 14-17th October, 2009.

7. **Németh, Sz.** – Orbán, M. – Gulyás, L. (2009) Comparative analysis of goat species' temperament. *2nd Animal Breeding Scientific Days of Gödöllő*, Gödöllő, 16-17th October, 2009.
8. **Németh Sz.** – Pajor F. – Póti P. – Gulyás L. (2010) Comparative analysis of milk yield ability and prolific data of home-bred goat species. *33rd Scientific day of Óvár*, Mosonmagyaróvár, 7th October 2010.

2. Scientific announces

1. Gulyás, L. – **Németh, Sz.** – Orbán, M. (2008) Examination of yielding and processing goat milk. *Present and future in the EU of breeding sheep*. Edited publication, Debrecen, pp. 283-201
2. Pajor, F. – **Németh, Sz.** – Barcza, F. – Gulyás, L. – Póti, P. (2009) Correlation of some udder and udder morphology feature and somatic cell number in hungarian noble goat species. *Animal breeding and foraging*. 58.:(4.) pp. 369-378.
3. Pajor, F. - **Németh, Sz.** - Gulyás, L. - Simó, K. - Ferentzi, B. (2009) Composition and particular features of grazed hungarian fallow goats' milk. *Dairy* 69:(2) pp. 3-8.
4. Póti, P. – **Németh, Sz.** – Gulyás, L. – Orbán, M (2009) Economical examination of goat milk yield and production. *Animal Welfare, Ethology and Housing Systems*. 4.2. pp. 549-554.
5. **Németh, Sz.** – Pajor, F. – Gulyás, L. – Póti, P. – Orbán, M. – Tóth, T (2009) Evaluation of temperament of different genotype mother goats kept among identical surroundings. *Animal Welfare – Ethology and keeping technology*. 5.:(3.) pp. 254-264.
6. Pajor, F. – **Németh, Sz.** – Gulyás, L. – Póti, P. (2010) Effect of udder nipple type to the development of some hygienic features of goat milk. *Acta agronomica Óvárensis*. Vol.52 Num. 2 pp. 19-29.
7. Mihályfi, S. – Németh, A. – **Németh, Sz.** (2010) Development of fertilizing results after applying mature synchronizing on goats

followed by cervicouterine insemination. *Agricultural Scientific Publications*. 2010/40. pp. 43-47.

3. Publications published written and proof-read in Hungarian and foreign language issues

1. **Németh, Sz.** – Gulyás, L. – Salamon, L. (2009) Examination of goat farm. *Farming*. 1. 53th Vol. pp. 27-31.
2. **Németh, Sz.** – Orbán, M. – Tóth, T. – Gulyás, L. (2009) Temperament examination of three goat species bred in Hungary within the same dairy. *Acta Agronomica Óvárensis*. Vol. 52. Num. 1, pp. 67-75.
3. **Németh, Sz.** – Orbán, M. – Gulyás, L. (2011) Temperament of different goat breeds: A comparative analysis. *Basics of Animal Welfare and Product Quality*. pp. 91-94
4. **Németh, Sz.** – Orbán, M. – Gulyás, L. (2011) Significance of udder conformation in different goat breeds. *Basics of Animal Welfare and Product Quality*. pp. 95-99.

4. Posters presented on scientific conferences

1. **Németh, Sz.** - Konrád, Sz. - Orbán, M. – Gulyás, L. (2009) Temperament of different goat breeds. *USAMVB Timisoara, Faculty of Animal Sciences and Biotechnologies, International Scientific Meeting*.
2. **Németh, Sz.** – Tóth, A. – Gulyás, L. (2010) Growth examination of three different goat species bred in Hungary. *52nd Georgikon Days*. Keszthely.

3. **Németh, Sz.** – Tóth, A. – Gulyás L. (2010) Growth examination of goats with different genotype. *33rd Scientific day of Óvár*. Mosonmagyaróvár
4. **Németh, Sz.** – Ari, M. – Pajor, F. – Póti, P. – Gulyás, L. (2011) Examination of breeding goats of milk producing type. *3rd Animal Breeding Scientific Days of Gödöllő, Gödöllő*
5. **Németh, Sz.** – Ari, M. – Pajor, F. – Póti, P. – Gulyás, L. (2011) Temperament examination of three goat species bred in Hungary within the same dairy. *3rd Animal Breeding Scientific Days of Gödöllő, Gödöllő*

5. Fully published summaries of scientific conferences

1. **Németh, Sz.** - Pajor, F. - Orbán, M. - Tóth, T. - Póti, P. - Gulyás, L. (2009) Evaluation of udder morphology of goats with different genotype. *In: 19th International Congress of the Hungarian Buiatric Company*. Debrecen, Hungary, 14-17th October, 2009, pp. 27-31.
2. Pajor, F. - **Németh, Sz.** - Gulyás, L. - Barcza, F. Póti, P. (2009) Correlation between udder conformation and some quality features of goat's milk. *In: 2nd Animal Breeding Scientific Days of Gödöllő*. Gödöllő, Magyarország, 16-17th October, 2009. pp. 218-224.
3. **Németh, Sz.** - Pajor, F. - Póti, P. - Gulyás, L. (2010): Comparative examination of home-bred goat species' milk yielding ability and reproduction data. *In: 33rd Scientific day of Óvár*. Mosonmagyaróvár, Hungary, 7th October, 2010., Paper 1

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3. Weidel, W. - Pajor, F. – **Németh, Sz.** - Gulyás, L. - Póti, P. (2010) Evaluation of appearance features of hungarian fallow kind goats. *In: 33rd Scientific day of Óvár.* Mosonmagyaróvár, Hungary, 7th October 2010., Paper 3.

6. Other notices

1. Orbán, M. – Gulyás, L. – **Németh, Sz.** (2009) Udder morphology examinations of jersey cows. *15th Youth Scientific Forum.* Keszthely, 16th April 2009.
2. Orbán, M. – **Németh, Sz.** – Gulyás, L. (2009) Situation of qualitative milk yield in the EU and Hungary *Vision of agriculture and the country, Scientific Conference.* Mosonmagyaróvár, 17-18th April 2009.
3. Orbán, M. – **Németh, Sz.** – Gulyás, L. (2009) Temper examination of Holstein-frieze and jersey cows. *51st Georgikon Days,* Mosonmagyaróvár, 1-2nd October, 2009.
4. Orbán, M. – **Németh, Sz.** – Tóth, T. – Gulyás, L. (2009) Udder morphological features of jersey cows. *19th International Congress of the Hungarian Buiatric Company,* Debrecen, 14-17th October, 2009.
5. Orbán, M. – Gulyás, L. – **Németh, Sz.** (2009) Udder-morphological features of first lactation Holstein-frieze and

Jersey cows. 2nd *Animal Breeding Scientific Days of Gödöllő*.
Gödöllő, 16-17th October 2009.

6. Orbán, M. – Gulyás, L. – **Németh, Sz.** – Tóth, T. (2009) Udder-morphological features of first lactation Jersey cows. *Acta Agronomica Óvárensis*. Vol. 51. Num. 2. pp. 63-72.